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full, the author concludes, that they are in the ratio of the areas of the orifices, independently of their shape ; and nearly as the square roots of the heights. In pipes bent at various angles the retardation occasioned by the flexure was not in proportion to their number.

A paper was read, "On the Sources and Nature of the Powers on which the Circulation of the Blood depends." By A. P. W. Philip, M.D. F.R.S. L. & Ed.

In the first part of this paper the author discusses the opinions which ascribe the powers that maintain the circulation in the veins to the elasticity of the heart, the resilience of the lungs, and the dilatation of the thoracic cavity in the act of inspiration. He shows experimentally that the circulation continues unimpaired when all those causes have ceased to operate ; and that the very structure of the veins, the coats of which are so pliable as to collapse by their own weight, when empty, renders it impossible that the motion of the blood could be maintained in them by any cause corresponding to a power of suction in the heart.

The latter part of the paper is occupied by an inquiry into the sources and nature of the powers which really support the circulation of the blood. The capillaries, he observes, maintain the motion of their blood long after the heart has ceased to beat ; this motion not being immediately affected even by the entire removal of the heart ; but being accelerated, retarded, or arrested, according as the action of the capillaries is increased, impaired, or destroyed, by agents of which the operation is wholly confined to the vessels themselves. As the destruction of the heart does not immediately influence the motion of the blood in the capillaries, so the action of this organ, when in full vigour, can produce no motion of the blood in the capillaries, when these vessels are themselves deprived of power. Experiments are related with the view of proving that the arteries and veins, and more particularly the latter, are also capable of carrying on the blood they contain, even in opposition to the force of gravitation, with the greatest ease, and without the aid of any extraneous power. With regard to the nature of the power exerted by the blood-vessels, the author shows that the capillaries are as readily influenced by stimulants and by sedatives, as the heart itself ; and that the arteries and veins may also be made to obey the action of stimulants ; and further, that the power of the vessels bears the same relation to the nervous system as that of the heart, which is peculiar, and very different from the relation subsisting between that system and the muscles of voluntary motion. From the whole of the facts and experiments stated in this paper, the author deduces the conclusions, that the circulation is maintained by the combined power of the heart and blood-vessels, and that the power of both is a muscular power.

A paper was read, entitled, "A critical and experimental Inquiry into the Relations subsisting between Nerve and Muscle." By

Wm. Charles Henry, M.D., Physician to the Manchester Royal Infirmary. Communicated by Wm. Henry, M.D., F.R.S.

It has long been a subject of controversy among physiologists whether muscular contraction is the immediate consequence of the action of a stimulus on the muscular fibre, or whether it is necessarily dependent on a change taking place in the nerve distributed to the muscle, and excited by the stimulus. This question, the author observes, is one which, from its very nature, is incapable of a direct solution, because the intimate connection of nervous fibres with every part of the muscles renders it impossible to distinguish on which of these classes of textures the impression of the stimulus is primarily made. The continuance of the motions of the heart after the destruction of the brain and spinal cord, and even after the entire removal of the heart from the body, has been adduced as an argument of the independence of the contractile property of the muscular fibre: but this argument the author considers as inconclusive, because the nervous fibres remaining in the heart, and expanded on the interior of its cavities, may still be capable of performing their usual functions, and act as the medium of excitation to the muscular fibres: an hypothesis strongly supported by the analogy of the voluntary muscles, which, though usually excited to action by changes taking place in the central portions of the nervous system, may yet, when removed from this influence, be made to contract by irritations applied to the trunks of the nerves that supply them.

As narcotic poisons act exclusively upon the nervous system, the author conceived that they might afford the means of eliminating the action of the nerves, and thus enable us to discover what share they contribute towards muscular contraction. On applying the empyreumatic oil of tobacco, or the hydrocyanic acid, to the sciatic nerves of a rabbit, he found that the functions of that part of the nerve which was in contact with the poison was destroyed, and that irritations applied to that part no longer excited contractions in the muscles. But when the portion which had been so affected was cut off, and the galvanic wire applied to that extremity of the nerves which remained attached to the muscle, contractions were produced. Similar results were obtained when the poison was applied directly to the brain. When, on the other hand, the poison was applied to mucous surfaces so as rapidly to extinguish life, the muscles throughout the whole body were paralysed and lost all capability of being excited to contraction.

The inefficacy of opium applied to the cardiac nerves in arresting the motions of the heart has often been alleged as a proof that those motions are independent of the nerves. But the author found on trial that a solution of opium injected into the cavities of the heart, or introduced into the intestine, immediately arrested the muscular actions of these organs.

These phenomena appear to the author to accord best with the hypothesis that the immediate antecedent of the contractions of the muscular fibre is a change in the ultimate nervous filament distributed to that fibre.